

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
60V	1.9mΩ@10V	220A
	2.5mΩ@4.5V	



合肥矽普半导体

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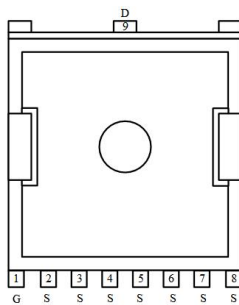
Feature

- Fast Switching
- Low Gate Charge and Rdson
- Advanced Split Gate Trench Technology
- **100% UIS TESTED**
- **100% ΔVds TESTED**

Applications

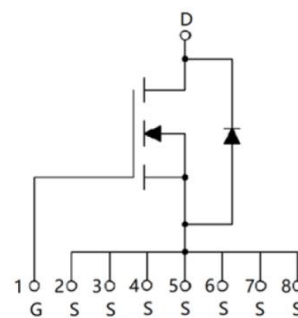
- Power switching application
- DC-DC Converter
- Power Management

Package

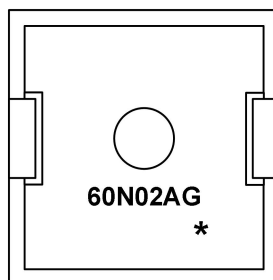


TOLL-8L

Circuit diagram



Marking



60N02AG : Product code
* : Month code

Order Information

Device	Package	Unit/Tape
SP60N02AGTO	TOLL	2000

Absolute maximum ratings (Ta=25°C, unless otherwise noted)

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current1 (Tc=25°C)	I_D	220	A
Continuous Drain Current1 (Tc=100°C)	I_D	147	A
Pulsed Drain Current	I_{DM}	880	A
Single Pulse Avalanche Energy ¹	E_{AS}	961	mJ
Power Dissipation (Tc=25°C)	P_D	264	W
Power Dissipation (Tc=100°C)	P_D	104	W
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	0.47	°C/W
Storage Temperature Range	T_{STG}	-55 to 150	°C
Operating Junction Temperature Range	T_J	-55 to 150	°C

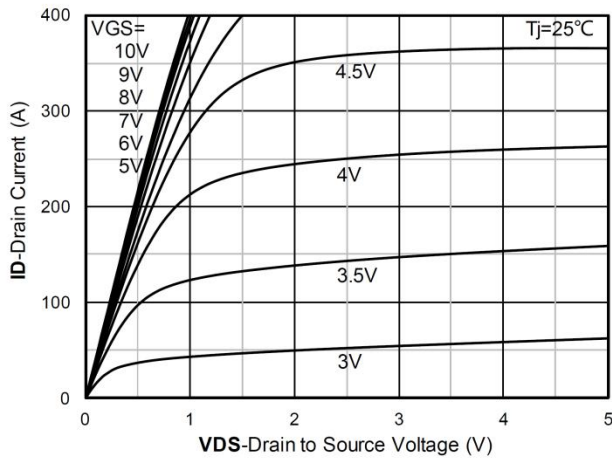
Electrical characteristics (Ta=25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	VGS=0V , ID=250uA	60	65	-	V
Drain-Source Leakage Current	IDSS	VDS=48V , VGS=0V	-	-	1	uA
Gate-Source Leakage Current	IGSS	VGS=±20V , VDS=0V	-	-	±100	nA
Gate Threshold Voltage	VGS(th)	VGS=VDS , ID =250uA	1.3	1.7	2.3	V
Static Drain-Source On-Resistance	RDS(ON)	VGS=10V , ID=20A	-	1.9	2.3	mΩ
		VGS=4.5V , ID=16A	-	2.5	3.2	
Gate Resistance	RG	f=1MHz	-	2.0	-	Ω
Dynamic characteristics						
Input Capacitance	Ciss	VDS=30V , VGS=0V , f=1MHz	-	4968	-	pF
Output Capacitance	Coss		-	2146	-	
Reverse Transfer Capacitance	Crss		-	88	-	
Total Gate Charge	Qg	VDD = 30V, ID = 40A, VGS = 10V	-	70	-	nC
Gate-Source Charge	Qgs		-	13.7	-	
Gate-Drain Charge	Qgd		-	18	-	
Gate Plateau Voltage	Vplateau		-	3.7	-	V
Switching Characteristics						
Turn-On Delay Time	Td(on)	VDD=30V , VGS=10V , ID=40A , RG=4Ω	-	11.5	-	nS
Rise Time	Tr		-	8.4	-	
Turn-Off Delay Time	Td(off)		-	48.5	-	
Fall Time	Tf		-	10.8	-	
Diode Characteristics						
Diode Forward Voltage	VSD	VGS=0V , IS=1A , TJ=25℃	-	-	1.2	V
Maximum Body-Diode Continuous Current	IS		-	-	220	A
Reverse Recovery Time	Trr	IS=50A , di/dt=100A/us , TJ=25℃	-	53	-	nS
Reverse Recovery Charge	Qrr		-	73	-	nC

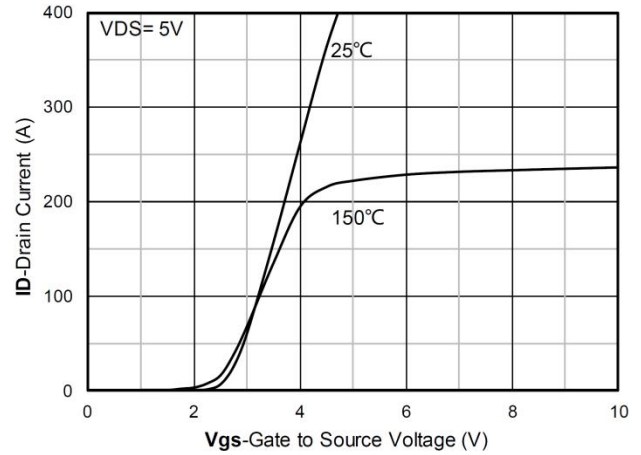
Note :

1. The test condition is $V_{DD}=30V, V_{GS}=10V, L=0.5mH, RG=25\Omega$;

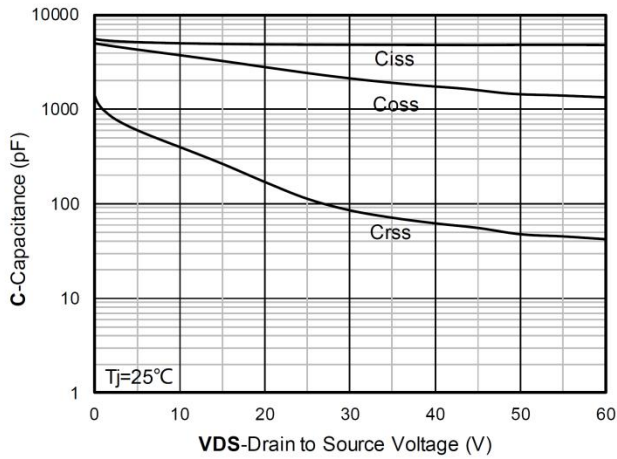
Typical Characteristics



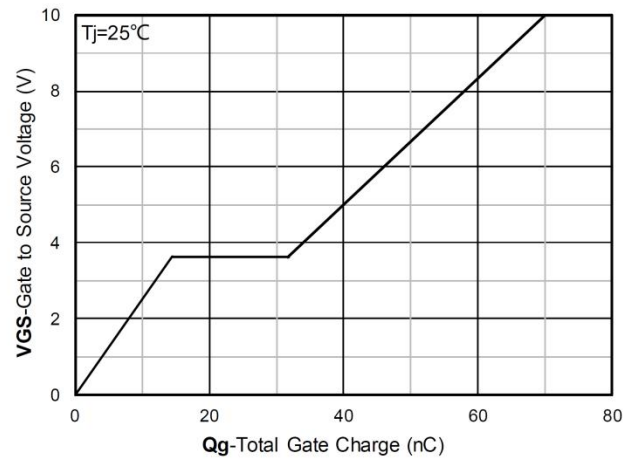
Output Characteristics



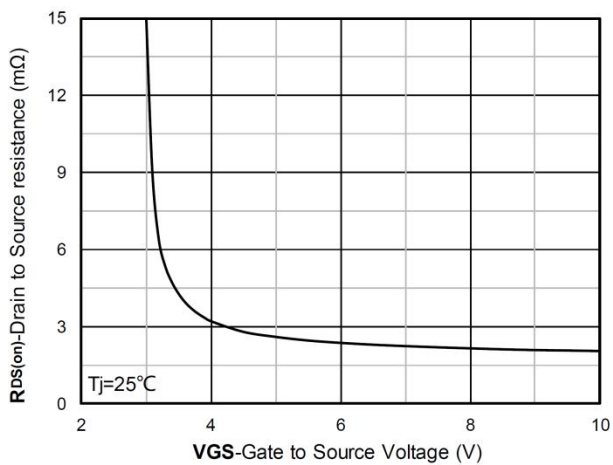
Transfer Characteristics



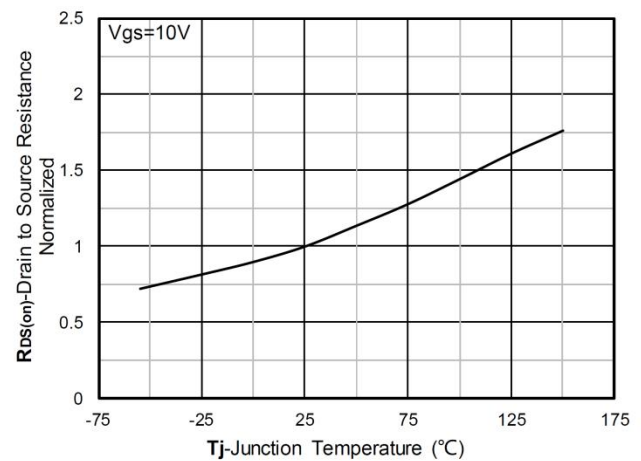
Capacitance Characteristics



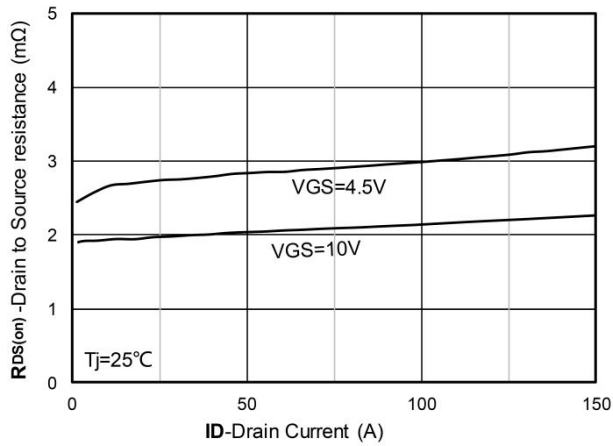
Gate Charge



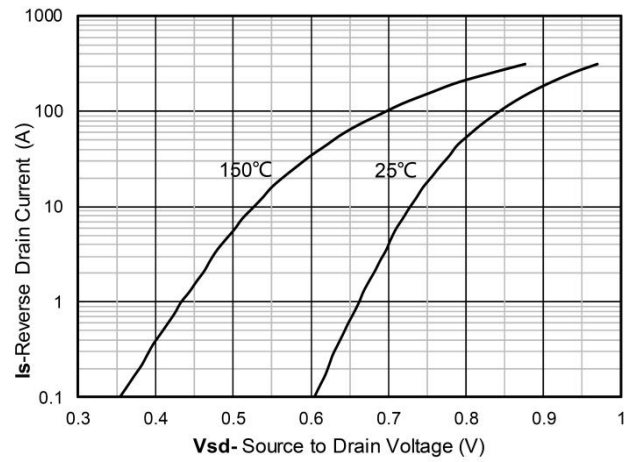
On-Resistance vs Gate to Source Voltage



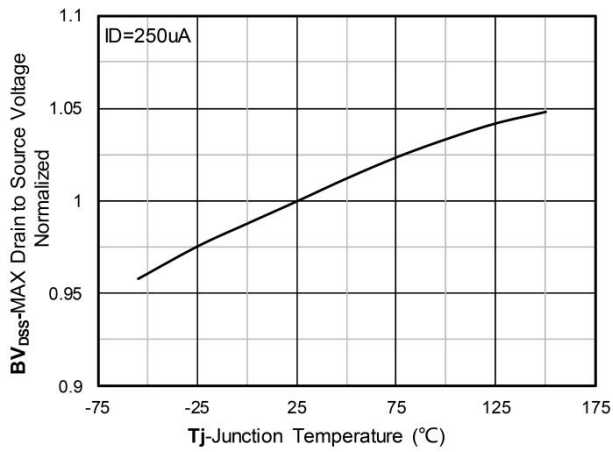
Normalized On-Resistance



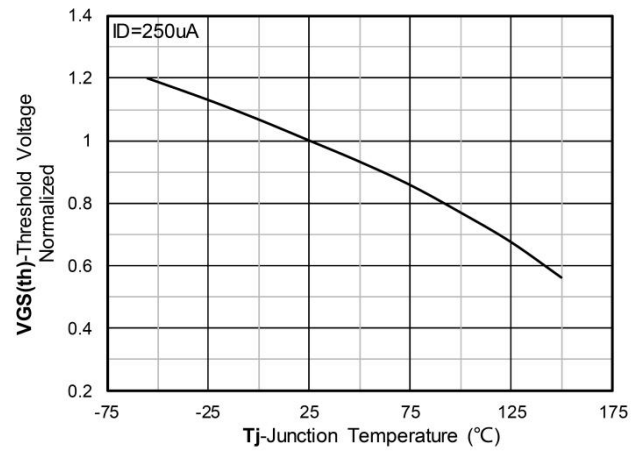
RDS(on) VS Drain Current



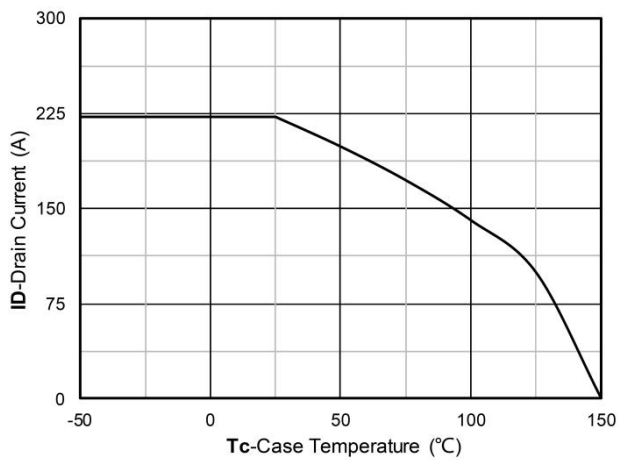
Forward characteristics of reverse diode



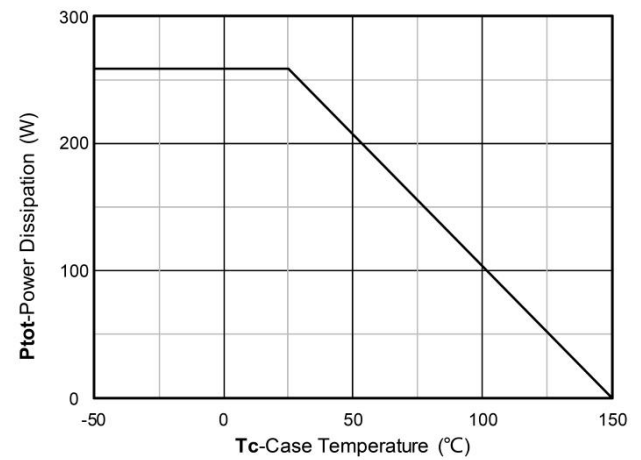
Normalized breakdown voltage



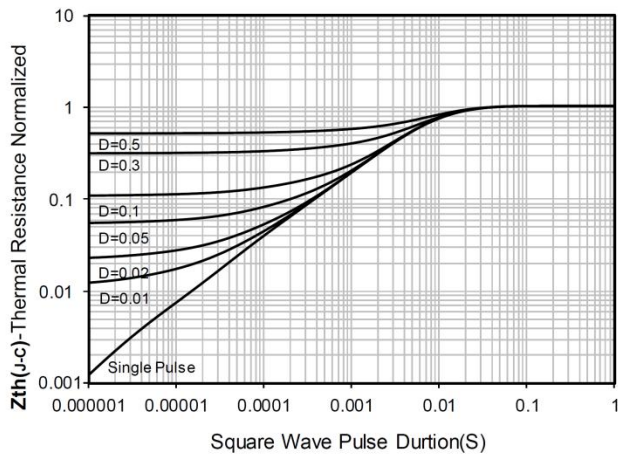
Normalized Threshold voltage



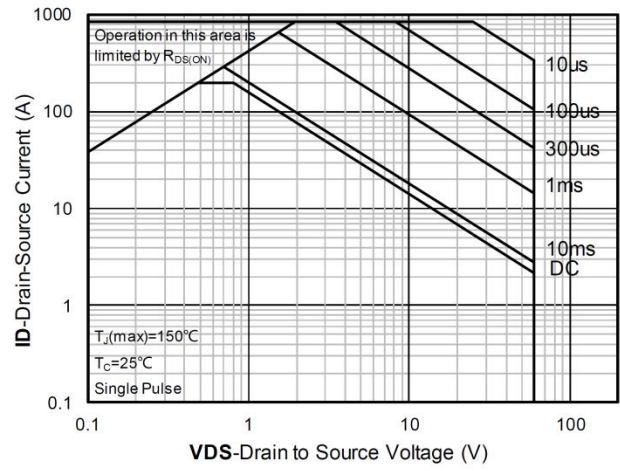
Current dissipation



Power dissipation



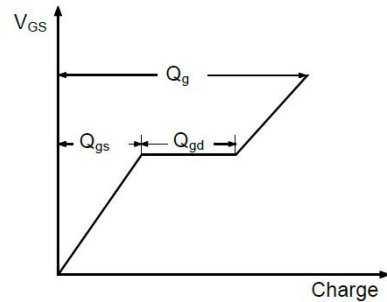
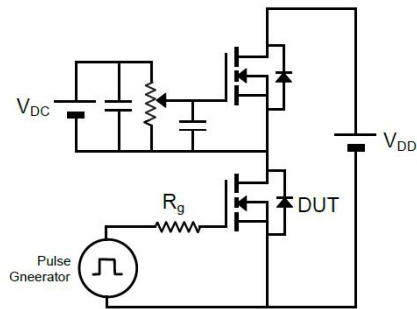
Normalized Maximum Transient Thermal Impedance



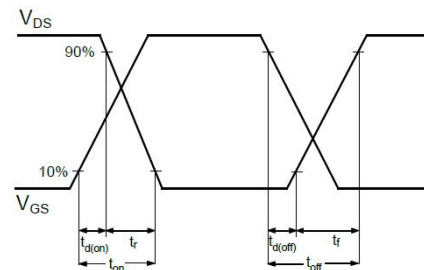
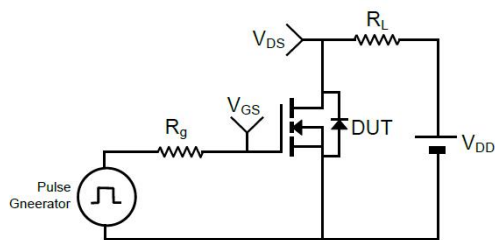
Safe Operation Area

Test Circuit

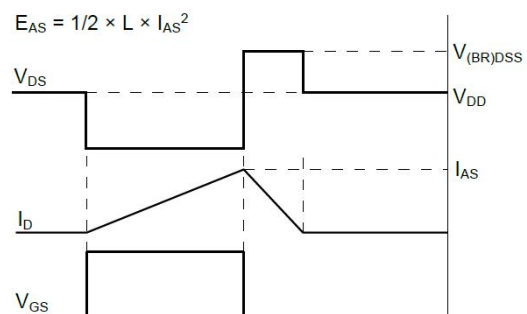
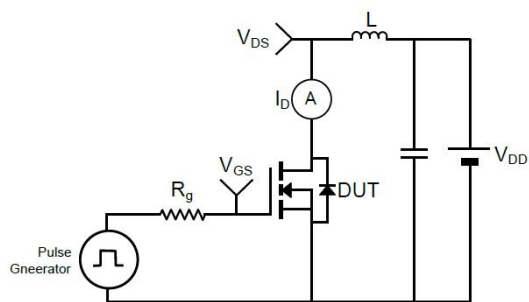
Gate Charge



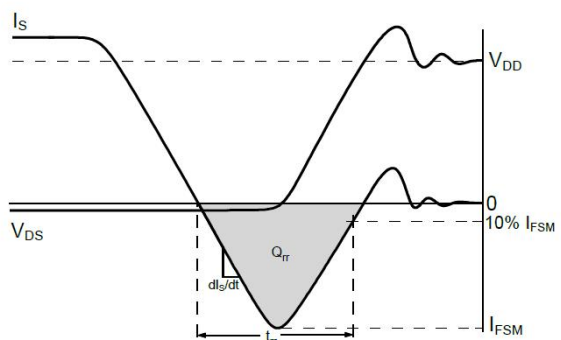
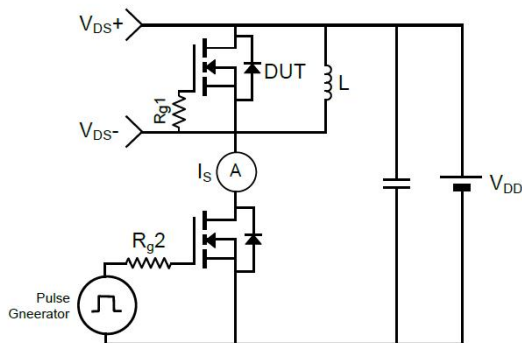
Resistive Load Switching Time



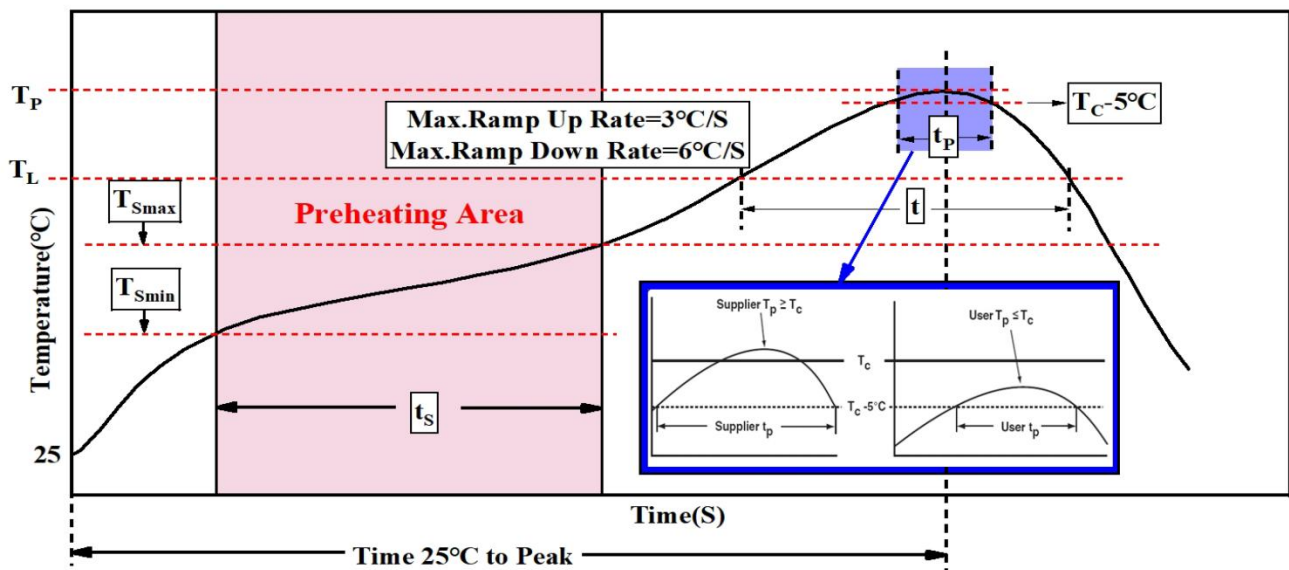
Un-clamped Inductive Load Switching



Drain-Source Body Diode Reverse Recovery



Temperature Profile for IR Reflow Soldering



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak		
Temperature min (T_{Smin})	100°C	150°C
Temperature max (T_{Smax})	150°C	200°C
Time (T_{Smin} to T_{Smax}) (t_s)	60-120 seconds	60-120 seconds
Average ramp-up rate (T_{Smax} to T_P)	3 °C/second max.	3°C/second max.
Liquidous temperature (T_L)	183 °C	217°C
Time at liquidous (t_L)	60-150 seconds	60-150 seconds
Peak package body Temperature e (T_P)*	See Classification Temp in table 1	See Classification Temp in table 2
Time (t_p)** within 5°C of the specified classification temperature (T_C)	20** seconds	30** seconds
Average ramp-down rate (T_P to T_{Smax})	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature (T_P) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum		

Table 1. SnPb Eutectic Process – Classification Temperatures (T_C)

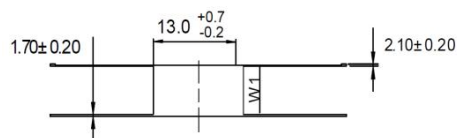
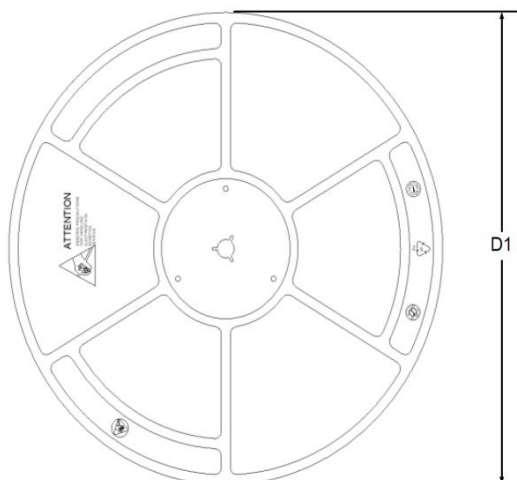
Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures (T_C)

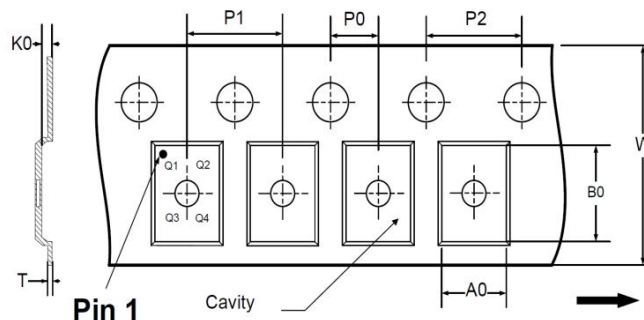
Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

TOLL-8L Reel Information

REEL DIMENSIONS

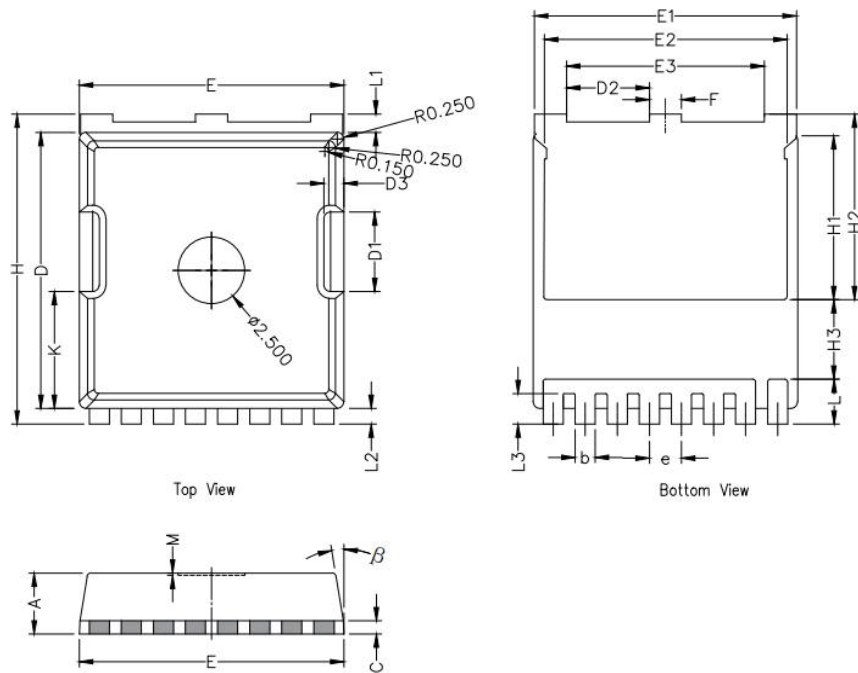


TAPE DIMENSIONS



- A0: Dimension designed to accommodate the component width
- B0: Dimension designed to accommodate the component length
- K0: Dimension designed to accommodate the component thickness
- W: Overall width of the carrier tape
- P0: Pitch between successive cavity centers and sprocket hole
- P1: Pitch between successive cavity centers
- P2: Pitch between sprocket hole
- T: Tape material thickness
- D1: Reel Diameter
- W1: Reel Width

DIMENSIONS										(Unit: mm)
Reel	D1	W1								Material
	330	24.4								Hips
Tape	P0	P1	P2	W	A0	B0	K0	T	Pin 1 Quadrant	Material
	2	4	12	24	10.3	12.1	2.6	0.35	Q1	PC
All dimensions are nominal										

TOLL-8L Package Information


Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	2.15	2.30	2.45
b	0.60	0.75	0.90
C	0.40	0.50	0.60
D	10.18	10.38	10.58
D1	3.15	3.3	3.45
E	9.70	9.90	10.10
E1	9.65	9.80	9.95
E2	7.90	--	9.15
E3	7.20	--	8.40
e	1.20 BSC		
F	1.05	1.20	1.35
H	11.45	11.70	11.95
H2	6.75	7.00	7.3
H3	3.00 BSC		
L	1.20	--	2.10
L1	0.50	0.75	0.90
L2	0.45	0.6	0.75
M	0.08 REF.		
β	8°	10°	12°